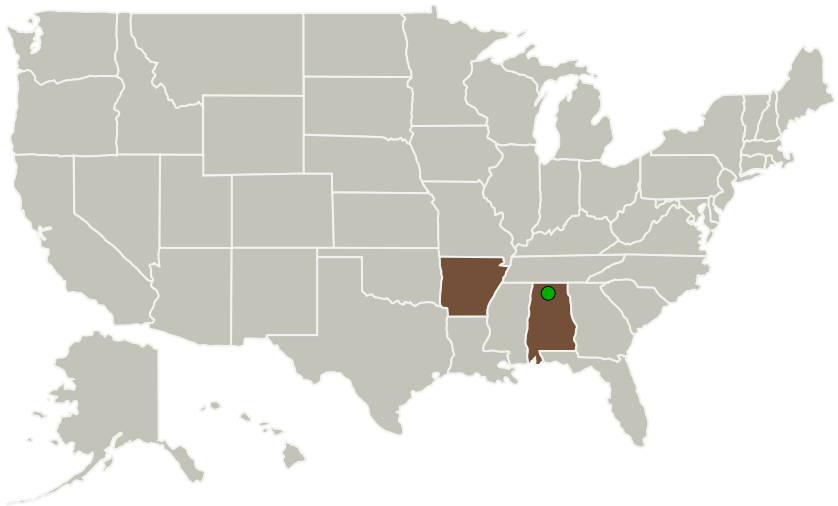
Wide-Temperature Radiation-Hardened Interface Chipsets Utilizing Delay-Insensitive Asynchronous Logic, Phase I

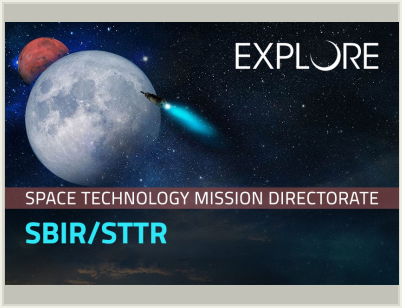
Completed Technology Project (2012 - 2012)

Project Introduction

There is a continual drive to move electronics out of the "warm box" to their point of use on space platforms. This requires electronics that can operate reliably over a wide range of temperatures and in the presence of radiation. The range of functions needed at various points across a given platform require use of digital, analog and high-voltage circuits, partitioned either independently or in combinations on the same chips. Currently, there is no "common denominator" integrated circuit process that can effectively support all applications; extreme-environment systems must include the best-in-class technologies. Circuit design techniques which can produce hardened circuits across a number of technology nodes are essential to producing IP that can be ported and applied to the best technology for the task at hand. Delay-insensitive (DI) asynchronous digital logic, such as NULL Convention Logic (NCL) is one such technique that can be applied to produce radiation-hardened wide-temperature electronics across many process nodes. DI logic can produce circuits with wide-temperature, threshold-independent operation and has shown tremendous potential for radiation-hardness through use of its dual-rail encoding scheme. DI logic has been successfully demonstrated in digital and mixed-signal applications down to 130nm in bulk silicon and SiGe processes over a wide range of temperature. An opportunity thus exists to apply the asynchronous DI approach to other space-applicable technologies where reliable digital processing needed, including SOI for high-voltage processes for power processing and conditioning. Proposed is the design of a wide-temperature wide-voltage range RS-485 interface suitable for power and actuator control applications built using DI-NCL gates and wide-temperature design techniques in a high-power radiation-hard process.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Ozark Integrated Circuits, Inc.	Lead Organization	Industry	Fayetteville, Arkansas
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Arkansas

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138570)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ozark Integrated Circuits, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Anthony M Francis

Co-Investigator:

Matt Francis

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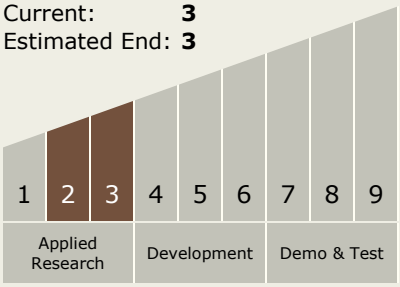
Completed Technology Project (2012 - 2012)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.3 Collaboration and Interaction
    - TX10.3.4 Operational Trust Building

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System